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EXAMINER	
BUI, PHUONG T	
ART UNIT	**PAPER NUMBER**
1638	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/563,194	JENSEN ET AL.	
	Examiner	Art Unit	
	Phuong T. Bui	1638	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 August 2009 and 21 May 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *30-58* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *30-58* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/21/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

OFFICE ACTION

1. The Office acknowledges the receipt of Applicant's amendments filed August 20, 2009 and May 21, 2009. Newly added claims 30-58 are pending and are examined.

All previous rejections not set forth below have been withdrawn. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

The claimed 70% sequence identity and SEQ ID NOs. 32, 39, 40, 47, 48 and 51-54 were first disclosed in PCT/DK04/00478. Accordingly, Applicant has priority benefit of July 2, 2004 filing date.

Specification

2. The amendment to the specification filed May 21, 2009 contains pages which are not legible. See Tables 1, 3 and 12.

Correction is required.

Information Disclosure Statement

3. A signed copy of Applicant's IDS filed May 21, 2009 is attached.

Objections

4. Claim 50 is objected to under 37 CFR 1.75(c) as being in improper form because claim 50 depends from two claims. See MPEP § 608.01(n). Correction is required.

Drawings

5. New corrected drawings in compliance with 37 CFR 1.121(d) are required in this application because shaded sequences are not legible. See Fig. 6b, for example. Applicant is advised to employ the services of a competent patent draftsperson outside

the Office, as the U.S. Patent and Trademark Office no longer prepares new drawings. The corrected drawings are required in reply to the Office action to avoid abandonment of the application. The requirement for corrected drawings will not be held in abeyance.

It is unclear whether Applicant intends for Fig. 8 to be color photographs. Furthermore, the photographs in Fig. 8 are considered to be defective images due to their poor quality. Color photographs and color drawings are not accepted unless a petition filed under 37 CFR 1.84(a)(2) is granted. Any such petition must be accompanied by the appropriate fee set forth in 37 CFR 1.17(h), three sets of color drawings or color photographs, as appropriate, and, unless already present, an amendment to include the following language as the first paragraph of the brief description of the drawings section of the specification:

> The patent or application file contains at least one drawing executed in color. Copies of this patent or patent application publication with color drawing(s) will be provided by the Office upon request and payment of the necessary fee.

Color photographs will be accepted if the conditions for accepting color drawings and black and white photographs have been satisfied. See 37 CFR 1.84(b)(2).

Correction is required.

Claim Rejections - 35 USC § 112, second paragraph

6. Claims 30-48 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

It is unclear what structures are encompassed by “LysM motifs”. While examples of LysM motifs are disclosed, it is unclear what other structures are also included. No definition is given for “LysM motif”.

Claim 30 recites a first polypeptide but there is no second polypeptide.

Claim 31 recites a second polypeptide but there is no first polypeptide.

Claim 33 is not further limiting because it does not require SEQ ID NO:8, 24 or their fragments.

Claim 34 is not further limiting because it does not require SEQ ID NO:8 or its fragment. Furthermore, in 34(a), it would appear that Applicant intends for "a fragment of said first polypeptide" to be "a fragment of said second polypeptide", and *vice versa* in claim 34(b).

In dependent claim 35, "a" should be amended to "the" for proper antecedence. See also claims 36, 37, 40, 49 and 50.

In claim 38, a nucleic acid molecule which hybridizes to the recited sequences is the noncoding strand and would not encode a polypeptide. Furthermore, "no less" sets a minimum level and "about" allows for values below the minimum level. Thus the metes and bounds of "no less than about" is unclear. All recitations of "no less than about" in subsequent claims are also rejected.

In claim 39, "said polypeptides or fragments" lacks antecedence.

In claim 41, it is unclear whether "the Nod-factor binding polypeptide" refers to the first or second polypeptide.

In claim 45, it is suggested the last recitation of "polypeptide" be amended to "element" for consistency with the preamble.

In claim 47, it is unclear whether "root specific" also applies to the native promoter.

In claim 48, it is unclear whether "constitutive" also applies to the native promoter.

In claims 54-58, it is unclear what constitutes a "variant", how a variant differs from a non-variant and how one skilled in the art can objectively determine one from the other. No comparative basis is given to determine such variants. It is unclear whether Applicant is referring to a structural or functional variant, or both.

Clarification and/or correction are required.

Claim Rejections - 35 USC § 112, first paragraph

7. Claims 30-54 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Applicant is invited to point to the page and line number in the specification where the combination of "70%" and "at least 2 extracellular domain LysM motifs" can be found. Applicant is also invited to point to the page and line number in the specification where "fragment comprises at least 2 extracellular domain LysM motifs" can be found. The specification discloses 70% sequence identity to particular sequences and their fragments, NFR5 and SYM10 containing 3 LysM motifs, NFR1 containing 2 LysM motifs, and "one or more isolated NFR polypeptides". However, "at least" is broader in scope than 2 or 3 motifs, and there is no disclosure of the combination of % sequence identity and number of LysM

motifs, and fragments of a 70% sequence identity sequence having at least 2 LysM motifs.

In claims 38 and 39, Applicant is invited to point to the page and line number in the specification where "no less than about" can be found. While the specification discloses examples of different hybridization conditions, the claims are not limited to the examples disclosed.

Absent of support, Applicant is required to cancel the new matter in response to the instant Office action.

8. Claims 30-58 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for the recited sequences, does not reasonably provide enablement for less than 100% sequence identity to the recited sequences and their fragments. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to practice the invention commensurate in scope with these claims.

The claims directed to sequences that have 70% sequence identity to various recited sequences and fragments thereof comprising at last 2 LysM motifs. With regard to sequences having less than 100% sequence identity to the recited sequences, the claims encompass unspecified base substitutions, deletions, additions, and/or combinations thereof while retaining the function of "selectively bind[ing]" strain-specific forms of Nod-factor. It is highly unpredictable which mutations will result in non-specific binding or which mutations will abrogate binding altogether. Applicant provided no working example or guidance as to which bases or amino acids can tolerate mutations.

The mutations are not limited to any particular domains or regions. The specification discloses some domains that are shared between different NFR polypeptides (p. 15) and alignment of 3 different NFR5 sequences (Table 1), but no guidance as to whether these domains or conserved regions will tolerate up to 30% mutations, or any mutation at all. While one skilled in the art can readily make mutations, further guidance is required as to how inoperable embodiments can be predictably eliminated other than by random trial and error requiring undue experimentation.

With regard to fragments, the breadth of the claims does not require the fragments to have 70-80% sequence identity to the recited sequences. In fact, the fragment may be in the region of the 20-30% sequence identity difference, provided that it has 2 LysM motifs, which appear to vary from plant to plant (see Figs. 2, 3, 6 and 11). The specification gives examples of some LysM motifs but does not disclose any particular length or structure for the LysM motifs which "selectively binds strain-specific forms of Nod-factor". Furthermore, while the LysM motifs may be critical for selective binding, it is highly unpredictable the fragments alone will selectively bind strains specific forms of Nod-factor. None of the working shows that fragments having 2 LysM motifs alone are operable for selective binding. The state of the art recognizes that specific protein binding generally requires the full-length protein having a specific 3-dimensional folding structure, which 2 LysM motifs alone would lack. Thus, Applicant has not enabled fragments having 2 LysM motifs for selective binding of strain-specific forms of Nod-factor.

With regard to claims reciting hybridization conditions (claims 38 and 45), the specification discloses NFR1 and NFR5 polypeptides have a 33% amino sequence identity similarity (Fig 11, p. 12). It is unclear how an NFR5 sequence such as a sequence encoding SEQ ID NO:8 hybridizes to SEQ ID NOs. 21-23, which encode NFR1 polypeptides. The recited hybridization conditions do not allow for binding of degenerant DNAs nor sequences having only 33% sequence identity at the amino acid level. It is unclear what other conditions are required for hybridization under the recited conditions to occur. Furthermore, sequences which hybridize to the recited SEQ ID NOs. are noncoding sequences and would not encode a Nod-factor binding polypeptide. Accordingly, Applicant has not enabled degenerant DNAs and noncoding sequences which also encode Nod-factor binding polypeptides or comprise 2 LysM motifs.

With regard to claims 54-58, the claimed method and plant obtained therefrom are not enabled because there is no guidance as to how nodulation frequency of a plant expressing a variant Nod-factor binding polypeptide is determined. It is unclear how a variant can be differentiated from a non-variant, either in terms of structure or function. Applicant provided no guidance as to how to calculate the nodulation frequency, and how the nodulation frequency is used in subsequent steps, as steps (b)-(d) do not refer to the nodulation frequency at all. In step (b), Applicant does not provide guidance as to which locus is linked to or within the allele encoding the variant, or how one skilled in the art would be able to identify the polymorphism at the undisclosed locus without undue experimentation.

Given the lack of working examples, lack of guidance and state of the art, one skilled in the art cannot make and use the claimed invention as commensurate in scope with the claims without undue experimentation.

Applicant traverses primarily that Applicant has sequenced 5 Nod-factor binding polypeptides from NFR1 and NFR5 family, they have a common N-terminal signal peptide, 2 or 3 LysM-type motifs for strain specific perception, a transmembrane domain, an intracellular domain comprising a kinase domain characteristic of serine/threonine kinases. Applicant further states Applicant's NFR5 proteins show 70-86% sequence identity with each other (80-90% sequence identity at the nucleic acid level), and NFR1 proteins show 73-79% sequence identity to each other (83-87% at the nucleic acid level).

Applicant's traversals have been considered but are deemed unpersuasive because they are not commensurate in scope with the claims. The claims only require "fragment comprises at least 2 extracellular domain LysM motifs", and the motifs do not have to have any % identity to any sequence but only that they "selectively bind[s] strain-specific forms of Nod-factor". Applicant does not provide guidance as to what amino acids or regions must be conserved. The scope of 70% identity is over the entire sequence, and it would require undue experimentation to determine which mutations would still allow for selective binding of strain-specific forms of Nod-factor. Applicant is clearly claiming sequences other than the NFR5s which have 70-86% sequence identity to each other, and the NFR1s which have 73-79% sequence identity to each other. It is highly unpredictable which naturally occurring proteins or synthetic proteins within the

recited % identities would also have the selectively binding specificity function as claimed. Accordingly, Applicant has not enabled the claimed invention as commensurate in scope with the claims.

9. Claims 30-58 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the **written description** requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

With regard to fragments comprising 2 LysM motifs, the claims encompass any sequence comprising 2 LysM motifs which do not have any sequence identity with the recited SEQ ID NOs. The LysM motifs may be in the region of 20-30% sequence identity difference among the sequences. The specification gives examples of some LysM motifs (Figs 2 and 6), but the claims are not limited to these motifs. It is unpredictable what the structure other LysM motifs have, or what mutations a sequence can possess and still by considered LysM motifs which selectively bind strain-specific forms of Nod factor. The motifs given in the Applicant's disclosure are not representative of all LysM motifs. Applicant has not adequately described the claimed LysM motifs. Accordingly, it cannot be determined from Applicant's disclosure Applicant is in possession of the LysM motifs as commensurate in scope with the claims.

With regard to sequences having less than 100% sequence identity to the recited sequences, Applicant does not disclose a representative number of species as encompassed by these claims. Applicant does not adequately describe the population

of sequences which have 70% identity to the recited sequences and "specific Nod-factor binding property". Applicant discloses only nodulation factors NFR1 and NFR5 from 5 dicot plants (no monocots). One skilled in the art cannot predict the structures of other nodulation factors based upon the disclosure of 2 nodulation factors, or the structures of sequences which have 70% sequence identity to the claimed sequences that would also have 2 LysM motifs and selectively bind strain-specific forms of Nod factor. The claims encompass other sequences, as well as mutants and allelic variants, and thus imply that structural variants exist in nature, yet no structural variant has been disclosed. The claims also encompass sequences from other species. The implication is that there is a gene and a protein other than that disclosed which exists, in nature or synthetically made, but the structure thereof is not known. Based upon the disclosure of sequences from five dicotyledonous plants, it is unpredictable which other sequence structures within the 70-80% sequence identity would also have "specific Nod-factor binding property". Thus, there are insufficient relevant identifying characteristics to allow one skilled in the art to predictably determine such mutants, allelic variants and sequences from other plants and organisms, absent further guidance. Accordingly, there is lack of adequate description to inform a skilled artisan that Applicant was in possession of the claimed invention at the time of filing.

With regard to claim 56, Applicant does not disclose a plant containing a variant Nod-factor binding polypeptide. It is unpredictable what structure the variant would possess, and which would have enhanced nodulation frequency. Therefore, Applicant

has not adequately described the claimed variant to show that Applicant was in possession of such variants at the time of filing.

Applicant traverses primarily that Applicant provided numerous representative NFR5 and NFR1 polypeptides.

Applicant's traversals are not persuasive because the claims are not limited to NFR1 and NFR5. Applicant disclosed sequences from 5 dicot plants, which does not allow one skilled in the art to predict other Nod-factor receptors from other plants including monocot plants. Moreover, the 70% identity is over the entire sequence. It is unpredictable what structures the fragments which have selective binding perception would have, since no percent identity is provided for the motifs or fragments. Accordingly, one skilled in the art cannot reliably predict the structures of the claimed sequences or fragments which would also retain the recited function based on Applicant's disclosure.

Claim Rejections - 35 USC § 102

10. Claims 30, 35 and 37-43 are rejected under 35 U.S.C. 102(a) as being anticipated by Madsen et al. (Nature, Vol. 425, No. 6958, 2003, pp. 637-640 (Applicant's IDS)). Madsen teaches sequences which have 100% identity to SEQ ID NOs: 6-8, 11, 12 and 15; 87% identity to SEQ ID NO:32; 71% identity to SEQ ID NO:40; and 73% to SEQ ID NO:48. A sequence alignment is not provided because there are common inventors/authors but can be provided upon request. Nucleic acids, expression cassette, vector and cell are also taught (Abstract, Methods). Accordingly, Madsen anticipated the claimed invention.

11. Claims 31, 36, 37-45, 49, 50, 52 and 53 are rejected under 35 U.S.C. 102(a) as being anticipated by Radutoiu et al. (Nature, Vol. 425, No. 6958, 2003, pp. 585-592 (Applicant's IDS)). Radutoiu teaches sequences which have 100% identity to SEQ ID NOs: 21-24 and 99% identity to SEQ ID NO:25. A sequence alignment is not provided because there are common inventors/authors but can be provided upon request. Nucleic acids, expression cassette, vector, monocot cereal plant, and method of producing plant are also taught (Abstract, Methods and last paragraph of Discussion). Accordingly, Radutoiu anticipated the claimed invention.

12. Claims 38-45 are rejected under 35 U.S.C. 102(a) as being anticipated by Limpens et al. (Science, Vol. 302, No. 5645, 2003, pp. 630-633 (W)). Limpens teaches a sequence which has 85% to SEQ ID NO:54. A sequence alignment can be provided upon request. Nucleic acid molecule, expression cassette, vector, plant cell and method of producing plant are also taught (throughout article). Accordingly, Limpens anticipated the claimed invention.

13. Claims 30, 31, 35, 36, 37 and 39-53 are rejected under 35 U.S.C. 102(a) as being anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over any one of Krusell et al. (Nature, Vol. 420, No. 6914, Nov. 28, 2002, pp. 422-426 (U)), Stracke et al. (Nature, Vol. 417, No. 6892, June 27, 2002, pp. 959-962 (previously cited)), Lange et al. (Plant Science, Vol. 142, No. 2, March 29, 1999, pp. 133-145 (V)), Endre et al. (Nature, Vol. 417, No. 6892, June 27, 2002, pp. 962-966 (Applicant's IDS)) and Applicant's admitted prior art. The claimed fragments are not required to have any sequence identity to the recited sequences. While 2 LysM motifs are required, the size,

structure and conserved amino acids of the motifs are not given. Accordingly, since each of the cited prior art teaches a receptor-like kinase from plant which is a Nod-factor binding element, the prior art would inherently possess the claimed motifs and would inherently binds strain-specific forms of Nod-factor. With regard to Applicant's admitted prior art, Applicant discloses prior art sequences from *Medicago truncatula* (Acc. No. 126779), *Oryza sativa* (Acc. No. 103891), *Arabidopsis thaliana* (Acc. No. 2g33580), *Oryza sativa* (Acc. No. BAB89226) and *Arabidopsis thaliana* (Acc. No. NP566689), each of which contains at least 2 LysM motifs (see Figs. 2 and 6). Moreover, page 20, lns. 23-27, of the specification discusses a prior art protein of *Lactococcus lactis* containing three LysM motifs. Nucleic acid molecules encoding the kinases, expression cassettes, vectors, transgenic plants, breeding methods and promoters are taught or obvious since these are expressed plant protein sequences associated with root nodulation. It would also have been obvious to introduce the kinase into a monocot such as a cereal to induce root nodulation in monocots for its desirable nitrogen-fixing symbiosis property. Accordingly, the claimed invention is anticipated by, or rendered obvious, by the prior art.

Remarks

14. No claim is allowed.

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Phuong T. Bui whose telephone number is 571-272-0793.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Anne Marie Grunberg can be reached on 571-272-0975. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Phuong T. Bui/
Primary Examiner, Art Unit 1638